## Last millennium climate and its variability in CCSM4

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The Last Millennium simulation of the Community Climate System Model version 4 (CCSM4) reproduces many large-scaled climate patterns suggested by historical and proxy-data records including cooling from the Medieval Climate Anomaly to the Little Ice Age, a "hockey-stick" pattern of surface temperature changes from 850-2005, a broad cooling with a delayed La Nina- type of pattern in the tropical Pacific response to large volcanic events. Atmospheric modes, one oceanic mode (the Pacific Decadal Oscillation), and one ocean-atmosphere coupled mode (the El Niño-Southern Oscillation) of variability show little or no change in their variances, teleconnection patterns and spectra between the Last Millennium simulation and the 1850 non-transient control run. Two oceanic modes, the Atlantic Multidecadal Oscillation and the Atlantic Meridional Overturning Current have higher variances and increased power at low frequencies in the Last Millennium simulation compared with the control run, suggesting long-term oceanic response to natural solar and volcanic forcings.